

Claims:

1. An article of footwear, which comprises:

a vamp;

a lower support connected to said vamp; and

5 at least one insert mounted in said lower support and which includes an airtight casing having a plurality of elements positioned therein which are elastically deformable such that the biomechanics of a foot of a user are optimized.

2. An article of footwear as claimed in Claim 1, wherein the air pressure in said casing is less than atmospheric pressure.

10 3. An article of footwear as claimed in Claim 1, wherein said deformable elements comprise cored elements for reducing the weight thereof.

4. An article of footwear as claimed in Claim 2, wherein said deformable elements comprise dimpled elements for reducing the weight thereof.

15 5. An article of footwear as claimed in Claim 1, wherein said deformable elements are interconnected by bridging portions.

6. An article of footwear as claimed in Claim 1, wherein said deflatable elements have an oval cross-section.

7. An article of footwear as claimed in Claim 5, wherein said elements comprise batteries of deformable elements.

20 8. An article of footwear as claimed in Claim 5, wherein said bridging portions are aligned with flex lines of the foot of the user.

9. An article of footwear as claimed in Claim 5, wherein said bridging portions are integrally formed with said casing.

10. An article of footwear as claimed in Claim 1, wherein said deformable elements are located in at least one of the heel portion, lateral portion, forefoot portion and metatarsal portion of the lower support.

11. An article of footwear as claimed in Claim 1, wherein said elements are substantially oval shaped in cross-section.

12. An article of footwear as claimed in Claim 11, wherein said elements comprise cored elements for reduction of weight of said elements.

13. An article of footwear as claimed in Claim 11, wherein said elements are interconnected by bridging portions.

14. An article of footwear as claimed in Claim 13, wherein said bridging portions are connected to said airtight casing.

15. An article of footwear as claimed in Claim 11, wherein said elements comprise batteries of at least three elements that are interconnected by bridging portions.

16. An article of footwear as claimed in Claim 11, which comprises a hinge member which interconnects adjacent elements wherein said hinge member is one of a hinge in alignment with at least one joint of a wearer's foot and a hinge which is oriented to match a rotational distortion thereof.

17. An article of footwear as claimed in Claim 1, wherein at least one of said elements is located on a medial border of a sole portion of the article of footwear so as to be

positioned substantially beneath an arch portion of the foot.

18. An article of footwear as claimed in Claim 1, wherein said elements include an element located in a heel portion of the sole and wherein said at least one element has a stiffness greater than said element located at the heel portion of the sole so as to reduce the degree of pronation of the foot of the user during running.

19. An article of footwear as claimed in Claim 17, wherein a forefoot portion of said at least one element comprises two adjacent separate elements with an area of separation therebetween corresponding generally to a metatarsal-phalangeal joint of the foot of the user.

20. An article of footwear as claimed in Claim 17, wherein a portion of said at least one element includes a forefoot pad located under a first, second and third metatarsal-phalangeal joint of the foot.

21. An article of footwear as claimed in Claim 17, wherein said at least one element includes a plurality of ovoid barrel elements having a longitudinal axis aligned with flex lines of the user's foot to permit greater ease of flexion.

22. An article of footwear as claimed in Claim 1, wherein said at least one insert comprises a heel insert having a central heel cushioning portion and a lateral cushioning portion with a hinged portion interconnecting said central heel cushioning portion and said lateral cushioning portion for absorbing impact forces from the heel of the foot of the user and for reducing leveraged acceleration of the sole towards the ground as well as a rate of pronation of the user.

23. An article of footwear as claimed in Claim 1, wherein said at least one insert comprises a heel insert having a central heel portion, a lateral cushioning portion and a hinged portion interconnecting said central heel portion and said lateral cushioning portion.

24. An article of footwear as claimed in Claim 23, wherein a rear lateral border portion of said insert is distanced from an outside border of the sole and midsole to permit encapsulation of insert with a foam member.

25. An article of footwear as claimed in Claim 11, wherein said insert comprises first and second heel elements and first and second forefoot elements divided about a substantially longitudinal axis so as to reduce leveraged acceleration of the foot of the user.

26. An article of footwear as claimed in Claim 11, wherein said insert comprises a plurality of cushioning elements located at a rear portion of the heel and at least one laterally positioned forefoot element to reduce any tendency of the sole to collapse under a forefoot lateral border portion of the sole during a cutting motion of the user when running.

27. An article of footwear as claimed in Claim 26, wherein said at least one laterally positioned forefoot element comprises a single element.

28. An article of footwear as claimed in Claim 11, wherein said insert comprises at least one heel element and a forefoot pad positioned inwardly from adjacent borders of the sole to permit encapsulation thereof in the sole.

29. An article of footwear as claimed in Claim 11, wherein said insert comprises a heel cushioning element positioned inwardly from an adjacent border of the sole to permit full encapsulation of said element in the sole.

30. An article of footwear as claimed in Claim 11, wherein said insert comprises a heel element for providing cushioning under the calcaneus portion of the foot and a separate forefoot element for cushioning the foot under the first four metatarsal-phalangeal joints of the foot.

31. A method of forming an insert for an article of footwear, which comprises:  
forming at least one insert from a plurality of interconnected elements; and  
inserting said at least one insert into a casing that is positionable in a sole portion of a  
article of footwear such that the biomechanics of a foot of a user wearing the article of  
5 footwear are optimized.

32. The method as claimed in Claim 31, wherein the step of forming the  
interconnected element comprises forming elements which are substantially oval shaped in  
cross-section.

33. The method as claimed in Claim 31, wherein the step of forming the elements  
10 comprises forming cored elements for reduction of weight of said elements.

34. The method as claimed in Claim 31, wherein the step of forming the elements  
comprises forming elements which are interconnected by bridging portions.

35. The method as claimed in Claim 34, which comprises interconnecting the  
bridging portions with an airtight casing.

15 36. The method as claimed in Claim 31, wherein the step of forming of the elements  
comprises forming elements as batteries of at least three elements and interconnecting said  
batteries by bridging portions.

37. The method as claimed in Claim 31, which comprises interconnecting adjacent  
elements of said plurality of elements with hinge members wherein said hinge members  
20 comprise one of hinge members in alignment with at least one joint of the user's foot and a  
hinge oriented so as to match a rotational distortion thereof.

38. A method as claimed in Claim 31, which comprises the step of forming the

elements such that at least one of the elements is located on a medial border of a sole portion of the article of footwear so as to be positioned substantially beneath an arch portion of the foot.

39. The method as claimed in Claim 31, wherein the step for forming the elements comprises forming the elements so as to include an element located in a heel portion of the sole and forming at least one of said elements so as to have a stiffness greater than the element located at the heel portion of the sole so as to reduce a degree of pronation of the foot during running.

40. The method as claimed in Claim 31, which comprises locating at least one of the elements in a forefoot portion of the article of footwear so as to have two adjacent separate elements with an area of separation therebetween corresponding generally to a metatarsal-phalangeal joint of the foot.

41. The method as claimed in Claim 31, which comprises locating at least one of the elements in a forefoot portion of the sole so as to include a forefoot pad located under a first, second and third metatarsal-phalangeal joint of the foot.

42. The method as claimed in Claim 38, wherein the forming of the elements comprises forming at least one element so as to include a plurality of ovoid barrel elements having a longitudinal axis aligned with flex lines of the user's foot to permit greater ease of flexion.

43. The method as claimed in Claim 31, wherein the step of inserting at least one insert comprises inserting at least one insert in a central heel cushioning portion of the sole and locating a lateral cushioning portion in the sole with a hinge portion interconnecting the central heel cushioning portion and the lateral cushioning portion so as to absorb impact forces from the heel portion of the foot and to reduce leveraged acceleration of the sole

towards the ground as well as a rate of pronation

5        44. The method as claimed in Claim 31, wherein inserting the insert comprises inserting a heel insert into the sole having a central heel portion, a lateral cushioning portion and a hinge portion interconnecting the central heel portion and said lateral cushioning portion.

45. The method as claimed in Claim 44, which comprises distancing a rear lateral border portion of said insert from an outside border of a sole and midsole to permit encapsulation of the insert with the foam member.

10       46. The method as claimed in Claim 31, wherein the step of inserting the insert comprises inserting an insert having at least first and second heel elements and first and second forefoot elements and divided about a substantially longitudinal axis so as to reduce leveraged acceleration on the foot.

15       47. The method as claimed in Claim 31, wherein the step of inserting the insert comprises inserting an insert having a plurality of cushioning elements located at a rear portion of the heel and at least one laterally positioned forefoot element to reduce any tendency of the sole to collapse under a forefoot lateral border portion on the sole during a cutting motion of the user when running.

48. The method as claimed in Claim 47, wherein at least said laterally positioned forefoot element comprises a single element.

20       49. The method as claimed in Claim 31, wherein the step of inserting the insert comprises inserting an insert having at least one heel element and a forefoot pad positioned inwardly from adjacent borders of the sole so as to permit encapsulation thereof in the sole.

50. The method as claimed in Claim 31, wherein the step of inserting the insert comprises inserting a heel cushioning element positioned inwardly from an adjacent border of the sole to permit full encapsulation of the element in the sole.

5 51. The method as claimed in Claim 31, wherein the step of inserting the insert comprises inserting an insert which includes a heel element for providing cushioning under the calcaneus portion of the foot and a separate forefoot element for cushioning the foot under the first four metatarsal-phalangeal joints of the foot.